MUELLER RECORD

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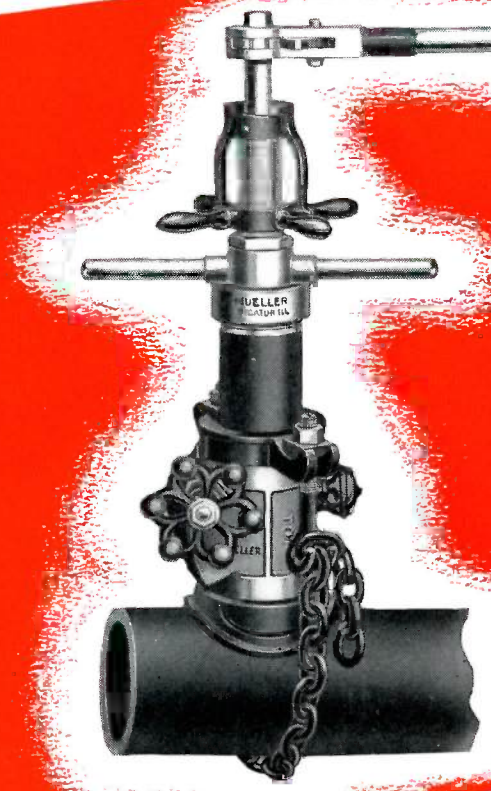

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MUELLER RECORD

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GENE J. KUHN, Editor

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COVER
Harold M. Lambert Studios

MOSTLY PERSONAL

IT SEEMS THAT we're always taking a backward glance in this column at some story that appeared in a previous issue of the *Mueller Record.* And this month is no exception.

Last issue we carried a story on the Texas Declaration of Independence, and while the *Record* was still on the press, the Navy Department announced that preparations were being made to tow the battleship USS Texas from Norfolk, Virginia, to San Jacinto, Texas, her arrival time scheduled for April 21. The date marks the anniversary of General Sam Houston's decisive defeat of Santa Anna—the battle that established the independence of the Republic of Texas.

The USS Texas will be transferred to the state of Texas as the result of a request by the people of Texas under the terms of Public Law 649 of the 79th Congress. The transfer will be an outright gift to the state, and the Texans are required to maintain her in "appropriate condition," and to pay all expenses of establishing her as a monument.

(Continued on page 31)

GREAT LAKES BUILDS A PIPE LINE GIANT

Largest line in U. S.—3,134.96 miles—traverses nine states and has a daily capacity of 104,600 barrels.

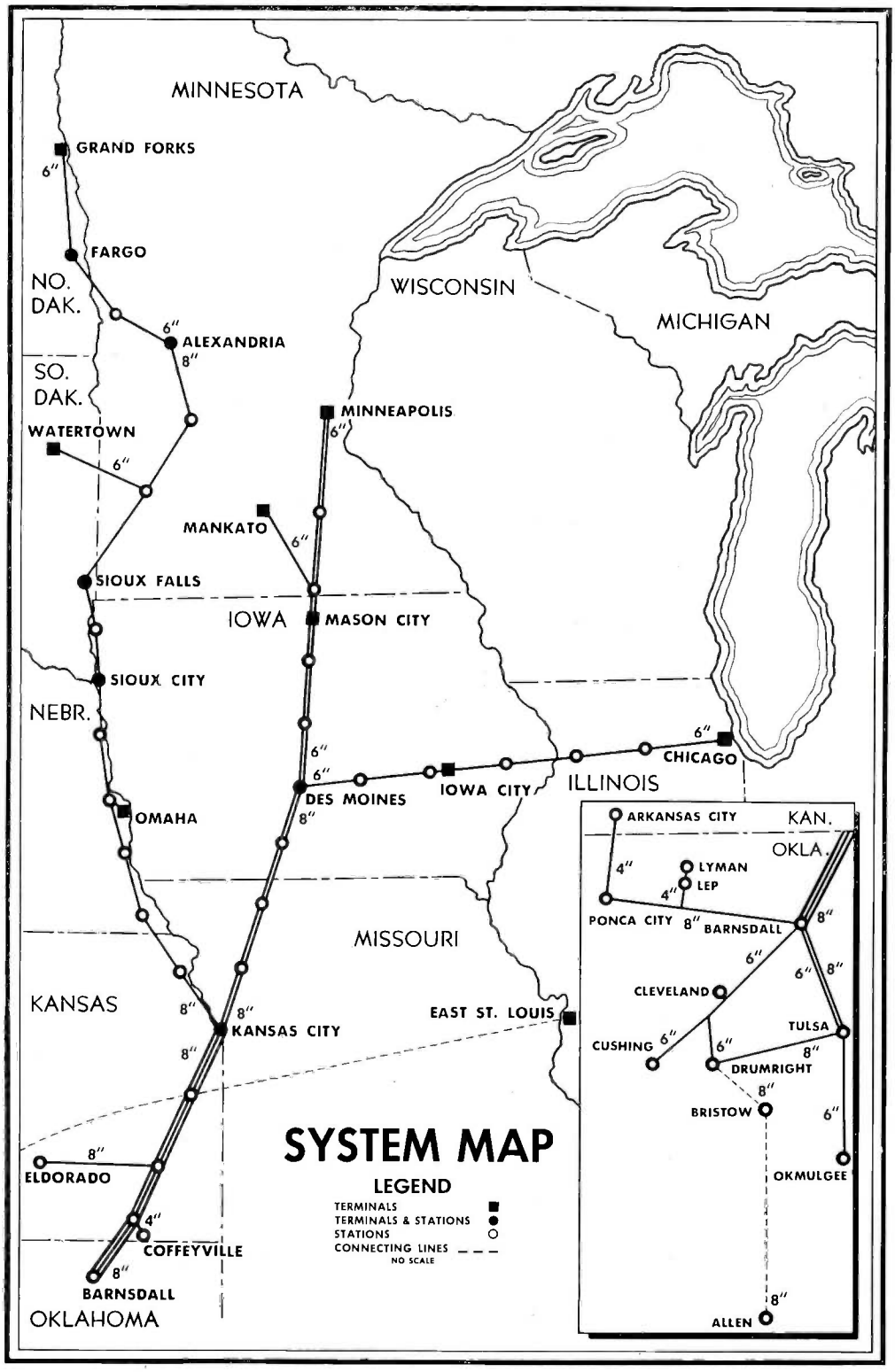
AS THE RESULT of a recently completed expansion and modernization program begun shortly after VJ-day in 1945, the Great Lakes Pipe Line Company now has the largest products pipe line system in the United States in both mileage and operating capacity.

The $30,000,000 program increased the system's capacity by 50 per cent, giving it a daily operating capacity of 104,600 barrels, and new lines brought the system's total to 3,134.96 miles. The system's lines traverse nine states and extend from Okmulgee, Oklahoma, on the south to the northern terminus, Grand Forks, North Dakota, sixty-five miles from the Canadian border, and from El Dorado, Kansas, on the west to Chicago, on the east.

Harry Moreland, president of the company, said the total program involved the laying of more than 1,200 miles of lines, including 886.8 miles of 8-inch pipe and the remainder 6-inch, the construction of fourteen new primary pump stations, eight new delivery terminals, the remodeling of the buildings and facilities at fourteen existing pump stations and two terminals on lines from Tulsa, Oklahoma, to Minneapolis, Minnesota.

Major portion of the new line construction—some 821 miles of it—was in the projection of a new route from Kansas City northwest, with terminals at Omaha, Nebraska; Sioux City, Iowa; Sioux Falls and Watertown, South Dakota; Alexandria, Minnesota; and Fargo and Grand Forks, North Dakota. All of these terminals are new with the exception of Omaha, which formerly was served by a line from Osceola, Iowa. In addition, two other terminals were constructed one on existing lines at Mason City, Iowa, and the other at Mankato, Minnesota.

In the modernization program of existing lines, the problems were much the same as those on the new route, except that fewer right-of-way easements had to be obtained and fewer terminal sites located. One of the big obstacles was at


MINNESOTA
GRAND FORKS
6″
FARGO
NO. DAK.
6″
ALEXANDRIA
8″
SO. DAK.
WATERTOWN
6″
WISCONSIN
MICHIGAN
MINNEAPOLIS
6″
MANKATO
6″
SIOUX FALLS
IOWA
MASON CITY
SIOUX CITY
NEBR.
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CHICAGO
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DES MOINES
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ELDORADO
OKMULGEE
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COFFEYVILLE
8″
BARNSDALL
OKLAHOMA
8″
ALLEN
SYSTEM MAP
LEGEND
TERMINALS
TERMINALS & STATIONS
STATIONS
CONNECTING LINES
NO SCALE

pump stations, where the work had to be carried on without disrupting normal operations.

A third 8-inch line was laid on the 204-mile route from Barnsdall, Oklahoma, to Kansas City, and a new 85.76-mile line was laid to this section at the Humboldt station, from refineries at El Dorado. Between Ponca City and Barnsdall two 6-inch lines were replaced with an 8-inch line. The 6-inch pipe in the No. 2 Tulsa-Barnsdall line also was replaced with 8-inch. These changes provided lines with matching capacities between these points and the Barnsdall-Kansas City lines.

Great Lakes has a relatively large number of points of origin of shipments. At present it receives products from nineteen refineries in Oklahoma and Kansas towns, and two more from a line owned jointly by Sunray Oil Corporation at Allen, Oklahoma, and H. F. Wilcox Oil and Gas Company at Bristow to Drumright, Oklahoma, where it joins a Great Lakes line. An interchange agreement with Phillips Petroleum Company's products pipe line division adds two more refineries at Borger, Texas. Shipments on the interchange agreement with Phillips are received by Great Lakes at Kansas City for distribution to Great Lakes terminals. In turn, movement of products of Great Lakes shippers may be sent over the Phillips line from Paola to East St. Louis.

Few of the refineries have large storage facilities. This means that Great Lakes has to move the shipments as soon as possible after they become available. Great Lakes has set 25,000 barrels as the smallest amount for any single shipment, enabling the company to hold to a minimum the mingling of products and to move them in a sequence that permits proper blending off. Large tank farms at each exchange and receiving point enables the company to spot as many as nine different products in the system.

All terminals to which Great Lakes lines are connected are owned by it, and the company is responsible for each shipment until the product is loaded into motor transport or tank car for jobber distribution.

Great Lakes is owned by eight oil companies: Continental Oil Company, Mid-Continent Petroleum Corporation, Sinclair Refining Company, Phillips Petroleum Company, the Texas Company, Skelly Oil Company, Cities Service Oil Company and the Pure Oil Company.

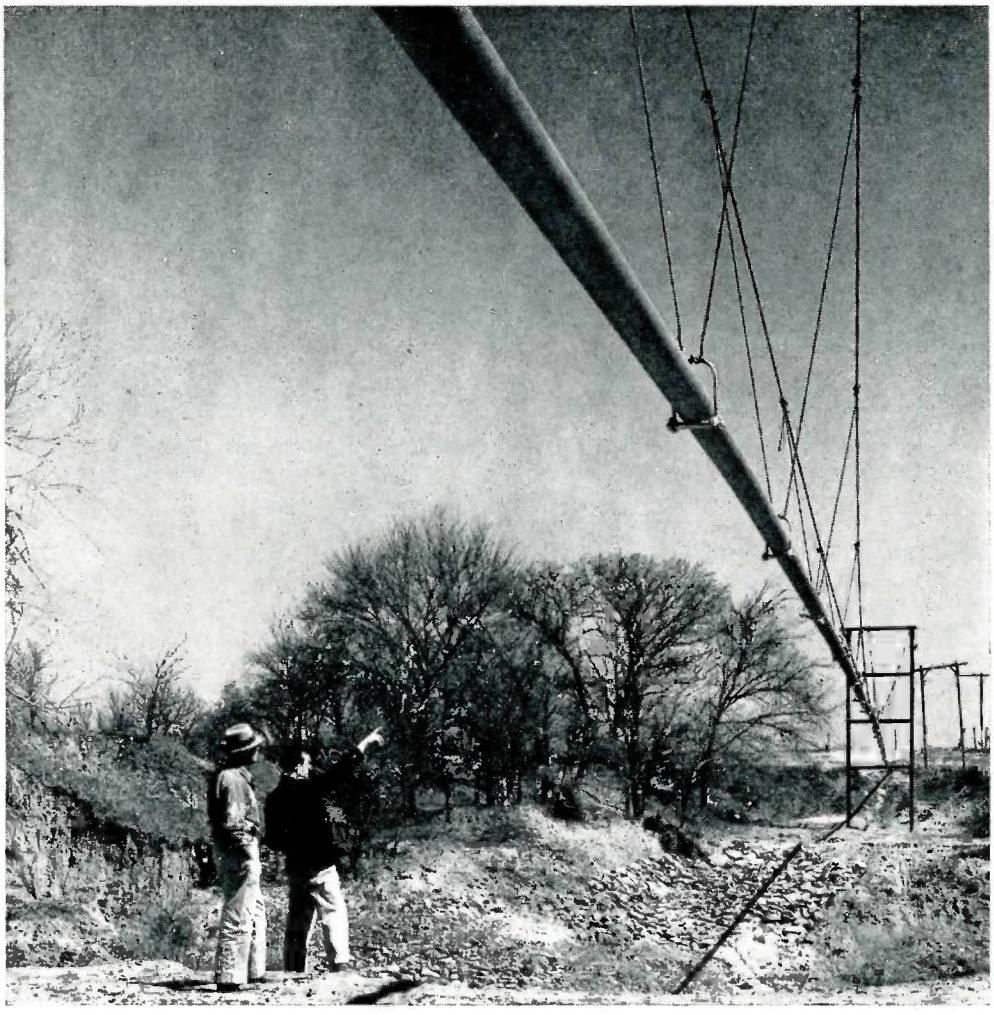
Nine other companies originate shipments from refineries: Sunray Oil Corporation, H. F. Wilcox Oil and Gas Company, Johnson Oil Refining Company, Deep Rock Oil Corporation, Midland Co-operative Wholesale, Tide Water Associated Company, the Kanotex Refining Company, Co-operative Refinery Association, and the El Dorado Refining Company.

When the vast expansion and modernization program was in the planning stage, shippers were asked to make an estimate of their transportation needs in the areas that would be served by the enlarged system. Based on these forecasts, the capacity was set at a figure which, it was indicated, would take at least five years to reach. By the summer of 1947, however, Great Lakes was moving that amount of traffic, and before the permanent construction was completed, temporary secondary stations using adapted aircraft engines as prime movers were being built to increase further the capacity of the system.

Preliminary to the construction in the territory northwest of Kansas City, the best available maps of the area were obtained, and from these a general route was selected between the then known points, the terminal cities. With this route as a guide, an aerial survey was made from which maps were constructed by the use of photogrammetry. This is an involved process, but the result is an aerial survey on which distance and elevation may be calculated directly from a photograph.

With this information, the locating engineer selected the exact route the line would follow. Plats giving its course through each property were prepared and supplied to the right-of-way agent.

Since winter was at hand in the northern states by the time these men started to work, the weather was a factor in their daily trips. They traveled to farm homes by automobile, horse and buggy,



An overhead section of the Great Lakes pipe line is shown here. The line was suspended over canals, whenever permission could be obtained from the drainage district. Cost of such crossings, the company found, was less than putting the line underneath a canal.

by sleigh, and at times, when roads were completely blocked, they donned skis or snow shoes.

When the permits were obtained, a ground party set stakes for the line to guide the contractor who had been selected on the basis of bids made on company specifications.

Permission of the War Department was required for crossing the Missouri river at Decatur, Nebraska; the Red river at Fargo, North Dakota; the Minnesota river at Granite Falls, Minnesota; and the Kaw at Kansas City. Along the Missouri river, particularly in Nebraska, large drainage canals were encountered. Wherever permission of the drainage districts could be obtained for construction of supporting towers the line was suspended over the canals. Three of these averaged 250 feet in length, and it was required that the pipe have a clearance of 40 feet to permit the passage of drag lines used in cleaning the canals. Suspensions at this height necessitated careful engineering and the use of heavy supporting towers and anchors. Nevertheless, the cost of such crossings was less than putting the line underneath the canal.

All pipe was received from the supplier in double random lengths of ap-

proximately 40 feet with end caps applied. These caps were removed immediately prior to welding the joints.

The 8-inch pipe has an outside diameter of 8.625 inches and an inside diameter of 8.219 inches with a weight of 18.26 pounds per foot. The pipe used was about evenly divided between electric-weld and seamless.

The 6-inch pipe, all electric-weld, has an outside diameter of 6.625 inches with a wall thickness of .1875 inches and a weight of 12.89 pounds per foot.

Electric welding was used to join the pipe. After the lines were laid they were machine cleaned and a fast drying primer coat was applied. This was followed by two coats of coal tar having a total thickness of 5/32 inch and a spiral wrap of asbestos felt completed the coating. Electric rectifiers supplied with purchased current were connected to the line at proper intervals to provide cathodic protection throughout the length of the new line. It was buried with a maximum of 24 inches of cover except where otherwise necessary because of crossings or other requirements. Across cultivated fields a minimum cover of 24 inches was used.

Prime movers are vertical six-cylinder, single-acting, four-cycle, turbo-supercharged Alco diesels, which develop 810 horsepower at 600 r.p.m. The engine is an exact duplicate of those used for locomotive power. Distillate is used for fuel, but at present a test is being made on an engine converted for use of natural gas. Great Lakes engineers say the economy of operation is attractive if the design can be made practical. The engine can be reconverted for distillate by half of a turn of a lever. This is the first attempt made to change this type of engine to natural gas fuel.

Design of the new terminals represents a decided improvement as compared with former facilities. From an adjoining paved highway, Great Lakes has built two concrete roads leading to the transport loading machine. Nearby is the tank car loading rack. Between the two lines of traffic is a building of brick and tile, 65 feet long and 30 feet wide which houses the office, laboratory, heating plant and store room.

In the completely equipped laboratory a chemist makes tests of all products. These are made on incoming shipments and again before the products are loaded out. The electric gauging dial in the office provides a means by which a reading may be taken instantly of any tank on the farm, correct to within an eighth of an inch.

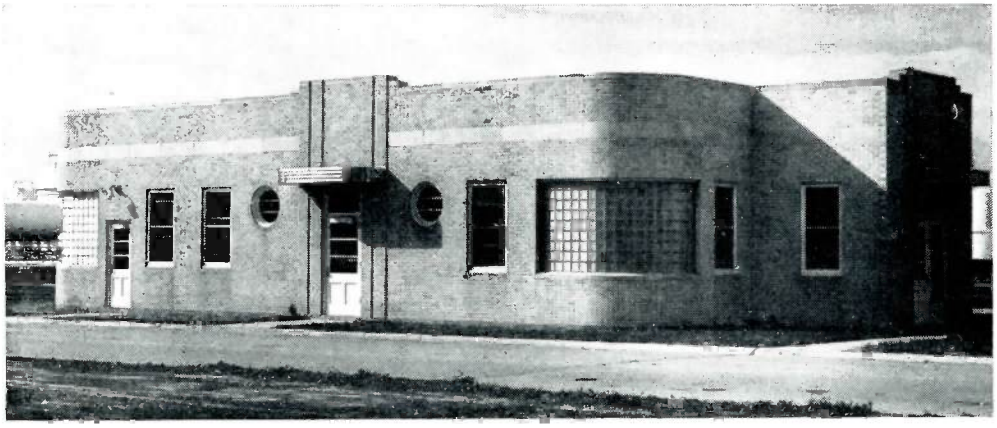
The tank farm and delivery system gain interest both by the facilities they have and also by much they do not have. In the latter category, they do not have an imposing maze of complex equipment at a central pump house, the piping is not an intricate weave of crossovers, switches and numerous valves.

Simplicity is the keynote of the new arrangement. Each tank is a separate unit complete in itself, having its own receiving and delivery lines, transfer pump and circulating system. With these facilities it is able to perform four functions: receive, circulate, blend and load, without interfering whatsoever with any other tank.

This system allows a tank changeover from one product to another to be made easily and quickly by the operating crew. Under the former method it was necessary for a special group to revamp the tank piping and pump connections, an expensive procedure in both time and money.

In case of heavy demands for a product, two or more tanks may be connected to common delivery facilities within five to ten minutes. The extreme flexibility of the system is illustrated by the 3,802 two-tank combination hook-ups possible at a 20-tank farm.

Each tank has a separate circulating system, but where tetraethyl lead is introduced into all tanks it is done by a common line. The lead tank is housed in a separate building which has on one end a room containing the dye pot from which dye is introduced into the gasoline. The brief time necessary to induct the lead and dye is the only period the common line is tied up. After these have been introduced the tank is circulated. With the new design tank spider is itself a small hydraulic pump which greatly speeds up the operation. The circulation for any tank is completed within 30 minutes.



One of the new tan brick and tile terminal buildings constructed during Great Lakes recent expansion and modernization program. Terminals on the new northwest line are located approximately 100 miles apart, giving shippers a chance to increase the pipe line portion of shipments and decrease the distance necessary to move products by motor or tank car.

The tanks are cone roof, connected with lifter roof tanks in a vapor recovery system. As many of the terminals are in regions where ice, sleet, and snow are commonplace in winter the lifter roof type tank is preferred. Low vapor products are handled in the cone roof tanks without vapor recovery connections.

Such a program as Great Lakes contemplated would have been an enormous undertaking at any time, and during the period in which it was carried out it assumed the proportions of a battle.

Materials were ordered shipped as soon as they were available, no matter what they were. Wire, nails, screws and numerous small items that ordinarily never would have been stored were taken as soon as they could be obtained and stocked in warehouses along the line from Oklahoma to the Canadian border. The wisdom of this course was proved many times. As an example, nails disappeared from the market and would have caused an expensive construction delay if the company had not followed this procedure. As it was, the company encountered a number of shortages, particularly in pipe.

An innovation in building procedure allowed the new line to be placed in operation months earlier than otherwise would have been possible. Several temporary steel buildings were purchased and erected on the permanent building sites. This was done so that if permanent construction became impossible and pumps and engines arrived, operations could be carried on temporarily under these shelters.

As pumps and engines were received they were set up and put into operation under temporary buildings. When materials arrived construction progressed under the temporary buildings. This had still another advantage, for bricklayers were able to work under protection from the weather. This was especially advantageous in the northern states.

As soon as roof and walls of the permanent buildings were completed, the temporary structures were dismantled and taken to another location. In these communities, people were treated to amazing one-day transformations. Driving by a Great Lakes station in the morning they would see the usual metal building. By evening a modern brick building had appeared in its place.

While this procedure permitted line operation, it meant that station personnel had to work under conditions similar to what a family would experience if it were to move into a residence as soon as the walls and roof were constructed and the floor in one room partly laid.

It was in this manner that the system operated for months at an enlarged capacity, moving millions of barrels of product to an area that was constantly demanding more gasoline, more distillate, more fuel oil.

Hesitancy in the start of construction or a slackening of effort at any of the stages of the program would have meant a further delay of months.

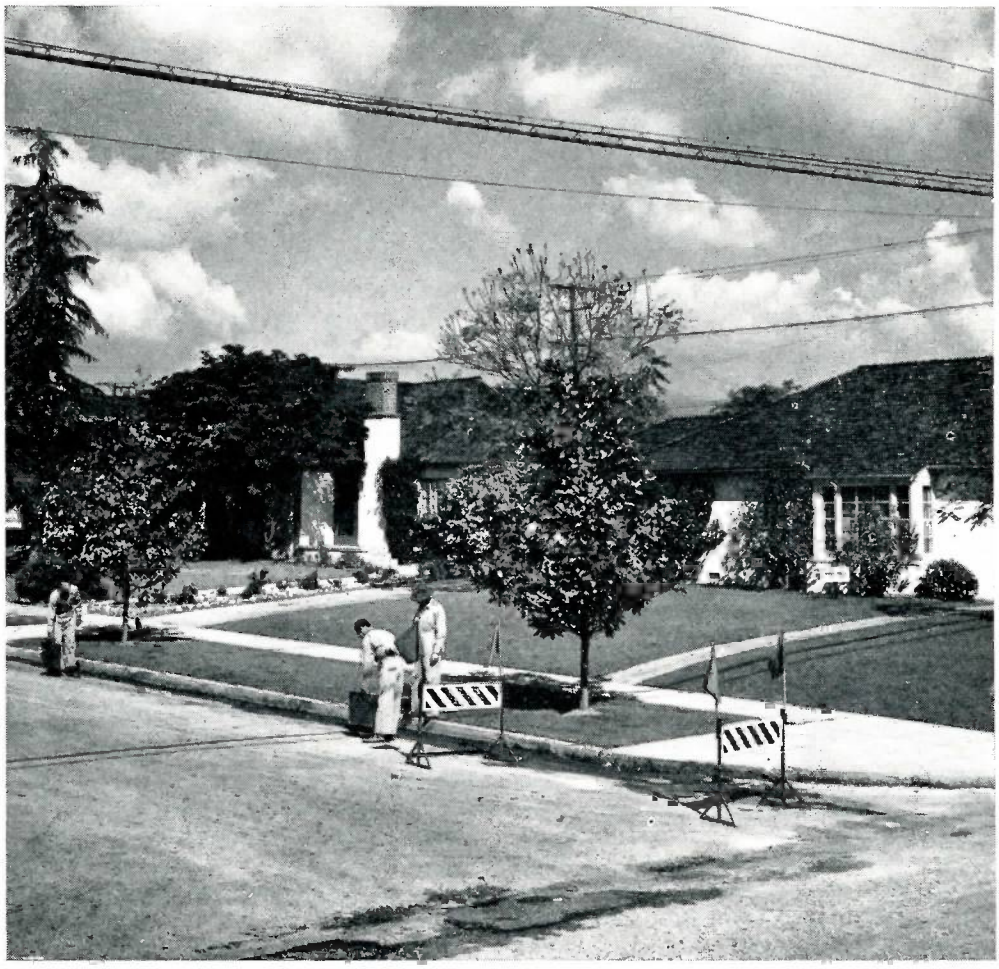
Southern California Gas Co. Handles Largest Volume of New Services in Its History

With more than a million customers at present and still expanding, company is second largest in U. S.

THANKS IN NO SMALL MEASURE to the use of Mueller Co. tools and fittings, last year the Southern California Gas Company was able to handle the largest volume of new service orders in its history.

During the year, the Company's Distribution Department installed several thousands of services in new homes and business structures in seven counties in Southern California. Total length of piping laid in the ground amounted to 3,770,266 feet, of which 70 per cent was steel pipe and the balance copper tubing.

Only by the use of the most up-to-date methods, together with efficient tools and fittings was the company able to keep pace with the unprecedented



A service crew uses a pipe locator, an instrument utilizing radio waves, to verify the location of the gas main as the first step in making a new service connection. Unnecessary excavation and destruction of pavement is by-passed by this up-to-date method.

The workman in the foreground is pressure testing pipe, which has been welded in proper length and shape. In the background, servicemen are using an air motor to bore a tunnel to the main without damaging either the pavement or the sidewalk.

growth in the territory it serves. According to recent estimates, population influx in Los Angeles County alone amounts to 150,000 persons a year, and more than a million people have poured into the southern part of the state in the past eight years.

Today, Southern California Gas Company is the second largest gas company in the United States, serving over 1,000,000 customers. The distribution system itself contains over 800,000 service laterals, supplied through more than 10,000 miles of mains.

Service installation methods employed by Southern California Gas Company service crews embody the most modern equipment and techniques available. The typical service installation begins with the location of the main under the street. In order to avoid any unnecessary disturbance of the paved surface, and any lost time, the service crews employ a pipe locator in determining the position of the main.

Only a small excavation is then required directly at the site of the main. A tunnel is bored from the location of the new service to the main with a boring machine, eliminating the need for tearing up sidewalks, lawns, or the paved street surface.

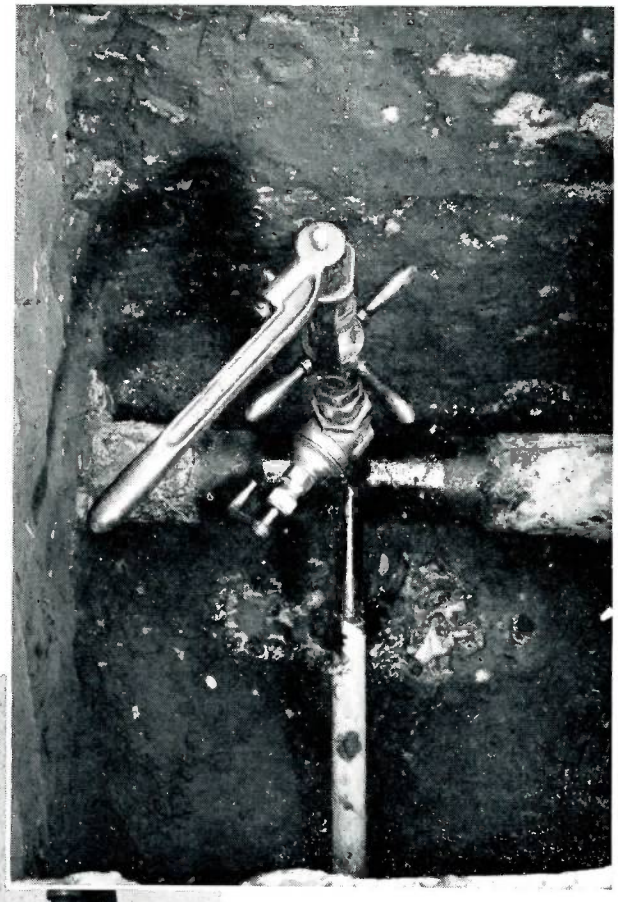
The sections of pipe are then strung out in position and welded together.

Above: Pipe sections are pushed through the bore to the gas main in the street. Natural deterioration and corrosion from moisture and other causes is prevented by wrapping and coating the pipe before it is placed underground.

Right: This photograph shows the service tie-in at the main, using a Mueller H-10410-99003 Pin-Off Tee before the main is drilled. The tee is welded to the main and service lateral, forming a permanent, trouble-free connection.

After welding and wrapping, the pipe is fed through the bore to the main. Connection is made at the main with a Mueller H-10410-99003 Pin-Off Tee. The Mueller "E-4" Drilling Machine is connected to the Tee and the hole is drilled into the main. The meter and service lateral are connected with a Mueller H-11100 Iron Body Service Stop, and the house line and vertical riser are joined by a Mueller H-11290-99001 5 Lt. rigid meter bar.

In this photograph, the cap has been removed from the H-10410-99003 Pin-off Tee and the Mueller "E-4" Drilling Machine has been connected, ready to drill into the main. The pin-off tee has an advantage over the regular welding tees in that if repairs to the line are required at some later date, the outside cap can be removed and the pin can be seated with a screw driver, thus shutting off the gas.



Southern California Gas Company makes extensive use of Mueller Co. products. In this photograph, a riser terminal connection with a Mueller H-11100 Iron Body Service Stop is shown at the bottom left. A Mueller H-11290 - 99001 5 Lt. rigid meter bar, holding a service lateral and house line is shown at top center.

(All photographs courtesy Photographic Section of the Advertising Department of Southern California Gas Company, Los Angeles.)

Underground Torpedoes For Natural Gas Storage

THE PUBLIC SERVICE Company of Northern Illinois, convinced of the safety and economy of storing natural gas in underground pipe sections, has planned for 1948 the construction of facilities for an additional 40 million cubic feet of storage, doubling its present storage installations.

Work has begun on a 20 million cubic feet installation on a 160-acre tract one mile west of Matteson, Illinois, and the remainder of the installation scheduled for this year will be an addition to the present underground storage field near Mount Prospect, Illinois.

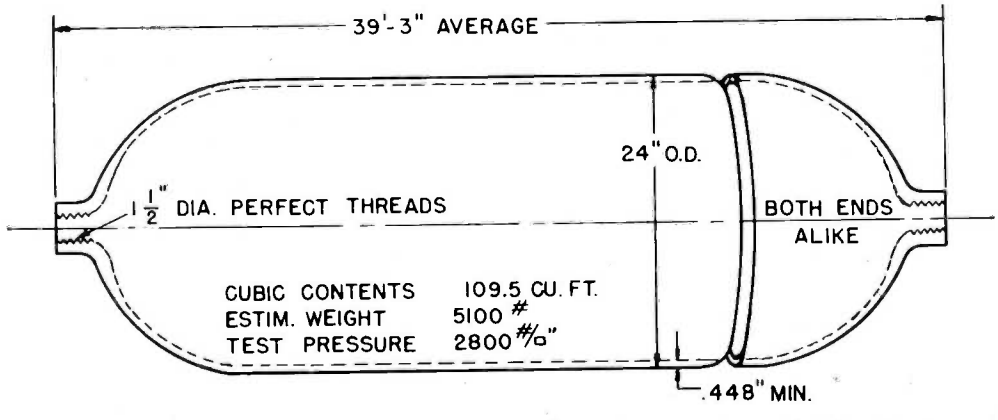
Using this new type of storage, natural gas is compressed to 2,240 pounds per square inch at 40 degrees Fahrenheit and stored in torpedo-shaped sections of high carbon alloy steel pipe, each section having an average length of 40 feet and an outside diameter of 24 inches.

The Public Service Company of Northern Illinois first tested this method of storage on a large scale in 1946, when it designed and installed a gas storage field near Kankakee, Illinois. This field, which served as a pilot plant for later installations, had a capacity of a million and a quarter cubic feet of natural gas.

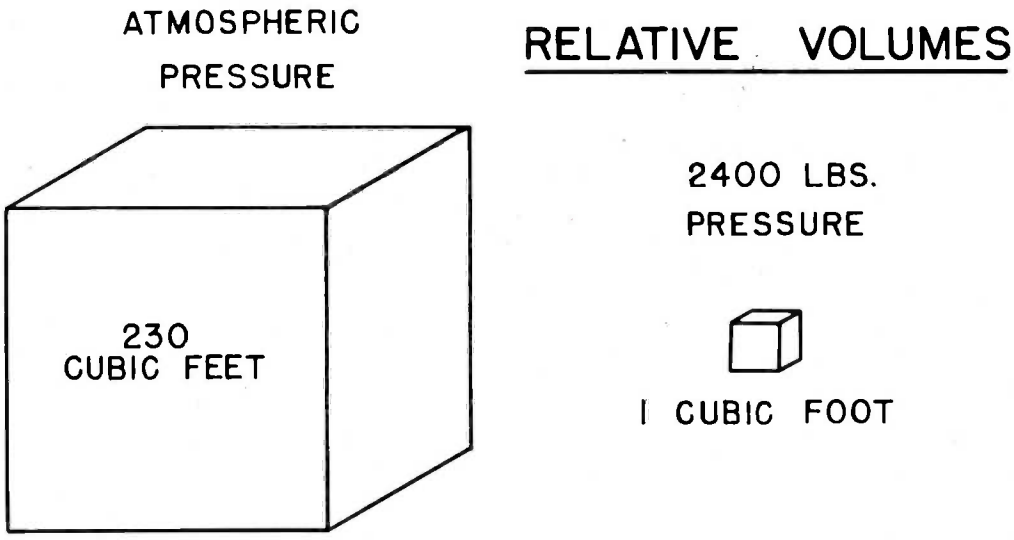
After the Kankakee installation proved entirely successful, from both cost and operating viewpoints, a similar but much larger installation was made in the company's northern operating division. The existing facilities for peak load and emergency supply to this division consisted of a gas manufacturing plant with five carburetted water gas sets and a conventional five million cubic feet low pressure holder.

To provide additional protection against temporary failure or diminution of the normal natural gas supply, which the company receives from the Texas Panhandle, some 1,000 miles from Chicago, propane facilities and 40 million cubic feet of natural gas storage in buried pipe sections were installed at Mount Prospect. These combined facili-

UNDERGROUND STORAGE UNIT DESIGN



The torpedo-like storage units, made of high carbon pipe, each hold 25,000 cubic feet of natural gas. The gas stored weighs in excess of 20 per cent of the weight of steel used in the pipe sections at 2,240 PSIA, which is 80 per cent of the test pressure of 2,800.



Under 2,400 pounds pressure, slightly less than that under which natural gas is stored in the underground pipe sections, about 230 cubic feet of gas occupy one cubic foot of space.

ties had sufficient capacity to supply two maximum days' load with a gas consisting of approximately 50 per cent natural gas, 25 per cent propane, and 25 per cent carburetted water gas. Such a gas came well within the range of acceptable burning characteristics.

All of these facilities were so installed and arranged that any one or all may be used for peak shaving if desired; that is, if on a very cold day, the load should exceed the quantity of natural gas available from the pipe line, the deficiency would be supplied by these facilities.

The 40 million cubic feet storage field was installed and in service only six months after the start of construction and within one year after authorization to proceed was granted—such speed naturally being one of the important advantages of this type storage.

The total cost of the installation, including compressor and sendout station, land, engineering and other costs, amounted to from $60 to $65 per 1,000 cubic feet of storage capacity. The cost of installation alone was in the order of $45 per 1,000 cubic feet. When the ultimate storage of 70 million C. F. is installed at the Mount Prospect site, the company anticipates that the average cost per 1,000 C. F. will be cut to $55.

The company estimates that at today's prices the conventional type of low pressure gas holder, either of the water seal or piston type, in which gas is stored at a fraction of a pound per square inch, would cost from three to five times that for the same amount of storage in underground, high pressure holders.

In deciding on the new method of gas storage, the following requirements had to be met: it should be safe, reliable, subject to quick installation, have a low operating cost, the investment required should be reasonable, and it must be fairly simple in design and operation. Underground storage at high pressure offered all of these, the company believed, although other methods of storage were considered.

Many of the costs entering into this type of gas storage—trenching, coating, laying, cathodic protect, land—are independent of the operating pressure; therefore, a high operating pressure obviously results in lower costs per unit of gas stored. The operating pressure selected was 2,240 pounds per square inch, the pressure at which the compressibility factor of natural gas is near the optimum.

Because of the departure of natural gas from the laws of perfect gases, the stored volume of the natural gas at 40 degrees Fahrenheit and 2,240 pounds per square inch pressure is approximately 43 per cent greater than the calculated storage of a perfect gas.

To prevent corrosion the pipe sections were coated with Bitumastic, a coal tar product, and wrapped with asbestos felt. Workmen here are shown cleaning and priming a pipe section preparatory to coating and wrapping. The work was done at the spot the pipe was to be installed in the ground, thus minimizing the handling of the sections after coating.

This compressibility factor becomes more favorable with decreasing temperature, and for this reason it is desirable to bury the pipe at a depth which will result in reasonably low temperatures in winter (about 40 degrees F. in the Chicago area), and yet minimize seasonal temperature changes. As a result of seasonal changes, some gas must be withdrawn from storage in the spring and summer and an equivalent amount put back into storage in the fall and winter. At the operating pressure of 2,240 pounds, each degree change in temperature causes a pressure change of about ten pounds, of which about one-half is due to the change in the compressibility factor accompanying the temperature change.

Each 1,000,000 cubic feet unit of storage includes 40 pipe sections, each section having a capacity of 25,000 cubic feet. In each unit, the pipe sections are spaced eight feet from end to end and fifteen feet from center to center line. Lanes approximately 50 feet wide separate each million cubic feet unit. Such spacing will permit an ultimate storage of 70 million cubic feet of gas on a 160-acre tract of land with generous clearances from property lines, the compressor station, and a creek which wanders through the Mount Prospect site.

The company selected the million cubic feet unit as a convenient size, since it is well within the size or capacity that is easy to operate or take out of service for repair. At Mount Prospect, each unit comprises only two and one-half per cent of the total storage of 40 million cubic feet. Thus, if any one unit of storage must be removed from service for any reason, the decrease in the quantity of stored gas is not of major consequence.

Each one million cubic feet unit has a two-inch manifold for filling and withdrawing gas. This is connected to a four-inch manifold header, which serves six 1,000,000 C. F. units, the four-inch manifolds being connected to two eight-inch manifolds leading to the compressor and sendout station.

Two high pressure compressors are used for filling the storage field. The compressors have a capacity of about one and one-half million cubic feet a day.

The equipment for sending out gas has a design capacity of 1.75 million cubic feet per hour. At this rate of withdrawal in which gas is reduced in pressure from 2,240 pounds to the distribution system pressure of 50 to 100 pounds, the gas must be heated prior to the reduction in pressure or the gas temperature downstream would be reduced to as low as 80 degrees below zero F. This low temperature might cause freezing of the regulators and undesirable contraction of the adjacent distribution mains. Heat exchangers, using low pressure steam, are used to heat the gas before the pressure is reduced.

It may be of interest to note that 25,000 cubic feet of natural gas weighs well over half a ton—or, in other words, the gas stored in each section weighs in excess of 20 per cent of the steel used in the pipe section itself. The plant doing

the forging on the pipe sections fabricated air cylinders for submarines during the war.

More than 15 miles of machine excavated trench were required for the 1,595 pipe sections in the 40 million cubic foot storage field at Mount Prospect. The original designs provided for a depth of about five feet, the exact depth to be determined by local soil and water conditions. The depth of the trench must be such that seasonal temperature changes are minimized and the expansion bends kept below the normal frost line.

As each million cubic foot unit was completed, it was pressured to 2,350 pounds per square inch with gas. As the gas cooled to ground temperature, usually within a few hours, the pressure would drop to 2,240 pounds. All joints, both welded and threaded, were then tested for leaks by covering them with water. After inspection, the connections were covered with sand and the ditch backfilled.

The torpedo-shaped storage sections and other underground piping were cleaned with air-driven air brushes and then were coated with Bitumastic, a coal tar product, and wrapped with asbestos felt as a protection against corrosion.

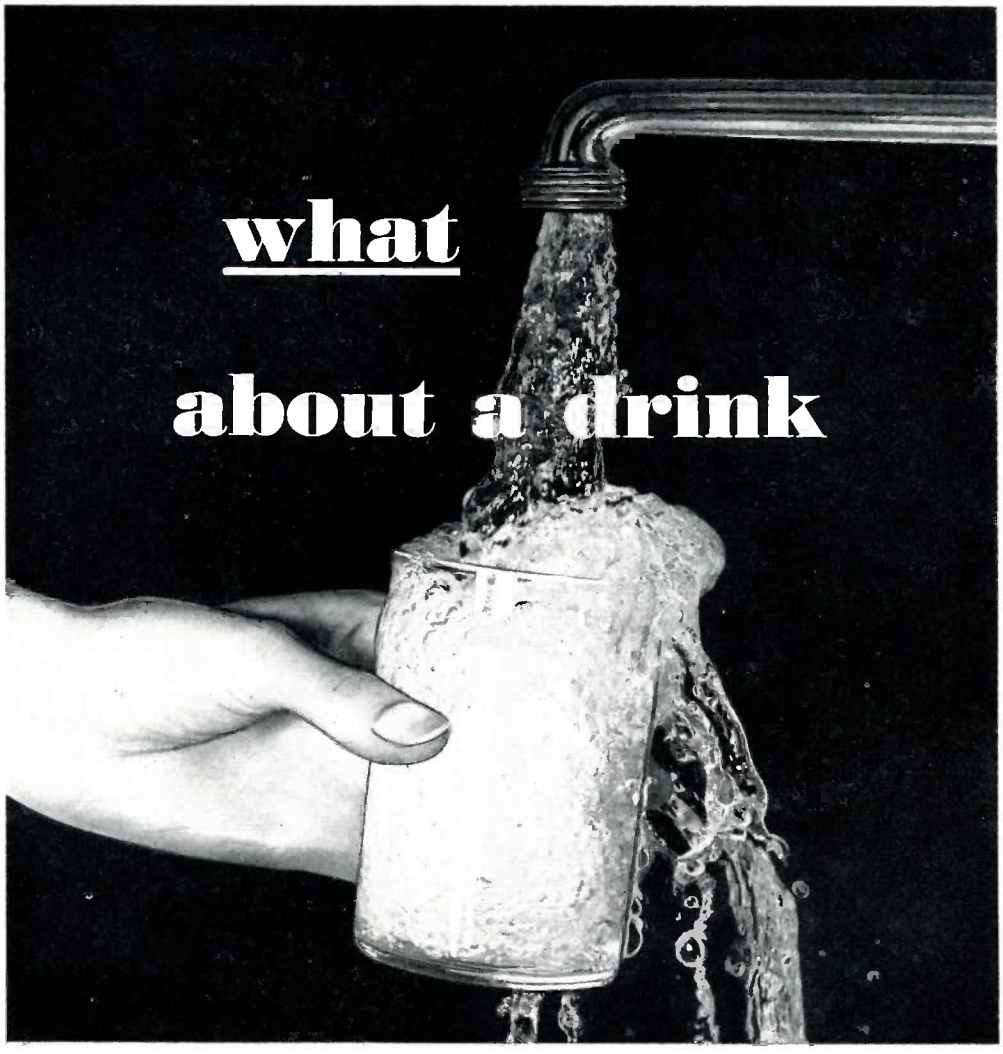
The coal tar pitch was heated to about 400 degrees F. and then poured on the pipe sections, which were set on a roller arrangement to facilitate the cleaning, pouring and wrapping of the sections.

After the pipe had been coated and wrapped, it was tested with a Holiday detector, an electronic device, to determine any spots where the coating was unsatisfactory. The device is in common use for testing the coating on steel pipe lines, prior to lowering the pipe into the ditch.

With more than 40 million cubic feet of this type storage already installed, another 12.5 million cubic feet under construction by associated companies, and with some 40 million C. F. planned for 1948 installation, the experience of the Public Service Company of Northern Illinois with the new method of storage has shown it to be safe, reliable, economical, pleasing in appearance, and quickly installed.

When required a high percentage of the stored gas can be sent out at high rates of flow, with nominal investment in sendout equipment. The company believes that this method of storage is ideal for many situations where natural gas must be stored against exigencies.

A 2½-ton pipe section is being lowered into a machine excavated trench, which is 36 inches wide. A special gauge was used to assure proper end-to-end spacing between sections, so that field cutting or bending of expansion bends would not be necessary. More than 15 miles of trenching were required for the 1,595 pipe sections in the 40-million C.F. storage field.



The water works industry, supplying 13,500 million tons annually, has set a world's record for purity.

EACH YEAR THE more than 13,000 public water works systems in the United States process in excess of 12,500 million tons of water for the 85 million persons they serve. These systems form an industry which has done such an exceptional job of protecting the public health that no other country in the world has a safer supply of water than can be obtained here by simply turning on a faucet.

A few months ago, however, the American Water Works Association, feeling that the industry had been misrepresented in articles appearing in several popular magazines, issued what it termed a white paper for the industry, its title, "SAFE . . . and you drink it!"

Among the points made in the paper were:

"Public water is one of the nation's great industries.

"The quality of drinking water supplied in North America has improved strikingly during recent decades.

"This improvement has resulted from the cooperation between the local water works engineers with the state and national authorities.

Most important factor in safeguarding purity of water is the constant check made by local authorities. Here Gerald Davis, Decatur city chemist, makes a bacteriological plate count.

Frank Turner, chemist at the Paris, Illinois, water works, examines lactose fermentation tubes for presence of gas, a presumptive test for E. coli, an organism indicating pollution.

"The record during recent years shows that there have been remarkably few failures among public water supply systems to protect the public health.

"Drinking water is not the dangerous product that some writers would lead you to believe it to be.

"Pollution of streams is a national disgrace—stemming from the indifference of cities, industries and farmers to the nuisance resulting from their wastes.

"The water works industry is greatly burdened by stream pollution, but it has kept ahead of the evil effects of pollution and provides safe drinking water for the American people.

"The greatest losses from stream pollution lie in the destruction of the recreational value of the streams.

"The public water supply is safe and the people drink it."

Water borne epidemics do occur from time to time, the A.W.W.A. acknowledges in its paper, but a tabulation released by the U. S. Public Health Service of water borne illness reported by state and federal workers in the past seven years indicates that two-thirds of the cases related to water obtained from other sources than the public supply.

"The mishaps to water works operation shown by the Public Health Service summary fell into four approximately equal groups," the A.W.W.A. paper said. "In one group well water was used without adequate protection. In another, surface water was used without treatment. In a third, not enough treatment was given to the water as it was being filtered. In the fourth group, the men in charge of water treatment did not do their job efficiently. They were careless and failed to meet the responsibility placed upon them.

"The water works industry is long on record in such matters. No well water should be used without protective treatment, unless it has an unblemished record of good quality. No surface water should be used without complete protection or treatment. It is never safe to skimp in the purchase and use of water treatment chemicals. No man in responsible charge of a water works system can ever afford to be careless in fulfilling his duties.

"The water works industry stands on record in opposition to practices which result in such failures to protect the people. At the same time it takes pride in the fact that statistically the failures of the past seven years have been amazingly few—certainly not the basis for creating fear in the mind of the public that all drinking water is dangerous. Even though the record of the past is

So that laboratory findings will be accurate, sterile containers for collecting water samples are furnished by the state board of health.

The number of bacteria which grow at body temperature are counted and recorded by Angeline Jacaway, foreground, and Phyllis Willson.

one of constant improvement, the water works industry is determined that the record of the years to come will be still better.

A safe water supply is the vital concern of everyone. To assure itself of safe water the public has been responsible for the enactment of certain laws and the creating of certain bodies, such as state departments of health. Water works men have set up their own associations to improve their professional qualifications. Keeping water safe requires constant vigil on the part of local water works employees, the various state departments of health or sanitation, and the United States Public Health Service. Through the cooperation of all three, the water works industry has made remarkable progress in supplying the public with a product of such high quality that its purity has come to be taken for granted by the public.

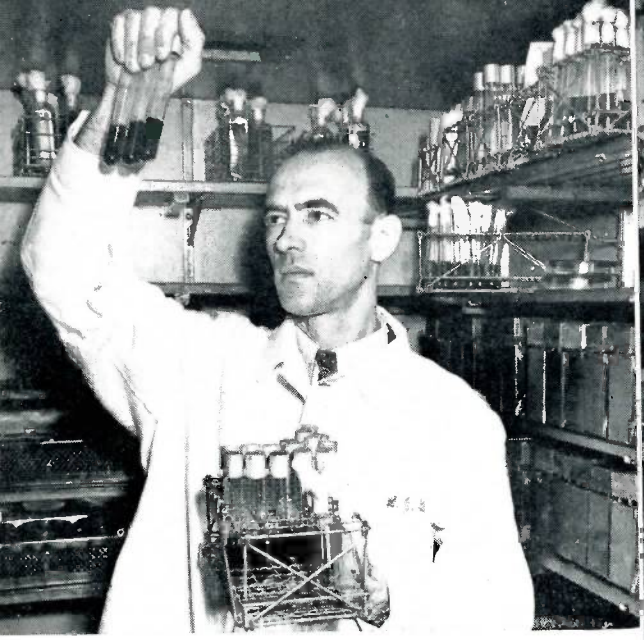
In the state of Illinois, which may be mentioned as typical, there are 706 public water supply systems of which 659 are municipally owned and 47 privately owned. These water supply systems have a daily pumpage of 1,153,000,000 gallons of water and serve 6,325,459 persons, about 77 per cent of the state's population. A total of 496 of the public water works systems are supplied by ground water and 210 by surface water.

During the past 25 years there have been only 43 water borne epidemics in the state, the Illinois Department of Health reports. However, not all of these were public water supply systems, since the report includes public, semi-public, private and institutional water supply systems.

One of the most serious outbreaks occurred in 1939 at the Manteno state hospital for the mentally ill, which operated its own water system. This epidemic involved 453 cases of typhoid fever and resulted in 60 deaths. The public health findings presented to the state's supreme court were held to have little probative value, but the fact remains that for eight years prior to the epidemic the state board of health warned the institution's officers of the possibility of an epidemic.

The case is mentioned here to illustrate how serious a water-borne epidemic can be. With this in mind, the public can be everlastingly grateful to the water works industry that typhoid, once one of the most common of diseases, is now a rarity.

Each year the laboratories of the division of sanitary engineering of the Illinois State Board of Health run from twenty-seven to thirty thousand bacteriological and chemical analyses of water samples. Water samples are submitted regularly from the various cities in the state, their frequency being determined primarily on the source of raw water and



Robert Scott, bacteriologist in the division of sanitary engineering, is shown in the state laboratory's large incubator as he examines fermentation tubes.

the reports of the fourteen district engineers who regularly inspect water sources and water works systems.

At the local level, most water works make their own chemical and bacteriological examinations of water samples, taken from raw water supplies, treated water, and water from various points in the distribution system. Their results are backed up by the results obtained in the state laboratories.

Testing the water, of course, is a check on the efficacy of the processing that goes on at the local water works, where the great responsibility lies and where such little credit is given by the public for its safe supply of water.

An indication of the pride the men of the water works industry in the state take in their profession is shown by the more than 400 applications the state department of health has received for the certificates of competency it issues. These certificates have no legal status and application for them is a voluntary matter. However, the certificates are an excellent indication of the operators' competency, and the standards for the men within the industry are becoming higher and higher throughout the country. Short courses, sectional and national conventions, and excellent trade publications keep them informed of new developments within their field.

Have a drink on your water works system. It's safe!

Linda Marsh, chemist, titrates the alkalinity of a sample of water. This is one of the routine chemical tests made in the analysis of water.

Arnold Westerhold smells a water sample as part of the physical examination, which also includes observation of its color, turbidity and sediment.

WATER

- - a real headache at San Diego, Calif.

By ROY E. DODSON, JR.
SANITARY ENGINEER, SAN DIEGO WATER DEPARTMENT

THERE IS A common expression, when things get tough, of being "up a creek without a paddle". This applies to many war-boomed communities, and particularly to their water systems. But imagine being up said creek without said paddle, and then have the *creek dry up!* This is the position in which San Diego's water system found itself, starting in 1941. San Diego has a climate which is renowned for its pleasantness, but a nice climate and an unlimited water supply do not necessarily go hand in hand.

From 1940 to 1945, water consumption in San Diego jumped from an average of 23.7 million gallons per day to 50 million gallons per day. Meanwhile, the net safe yield of the local supplies remained at about 27 m.g.d. It was like drawing more money from the bank than was deposited . . . it couldn't go on forever! Before we go into the measures which were used to avoid bankruptcy, let us take a quick look at the system and its background.

FIRST WATER SUPPLIES

The first water supplies in the San Diego area were simply wells dug in the scattered river bottoms. The Franciscan Fathers, trying to raise enough food to maintain Mission San Diego, finally realized that shallow wells were an undependable water supply in this arid land. In about 1790 they embarked upon the first "aqueduct" supply in the western United States. Eventually they built a dam of burnt tile and rock, laid in lime mortar, in the San Diego River channel. From this they brought impounded river water to the Mission through some six miles of tile-lined ditch, laid on grade along a rocky gorge.

Nearly 100 years later, the growing village of San Diego was supplied with a series of wells, a steam pump, a hilltop reservoir and several miles of pipe leading to the town. But the agricultural hinterland had begun to depend upon almost constant irrigation, which had to be backed up by a long-range water supply. Various impounded surface supplies were developed, so that the often-scant winter rains could be stored and used during dry periods. These irrigation reservoirs eventually became the backbone of the present system.

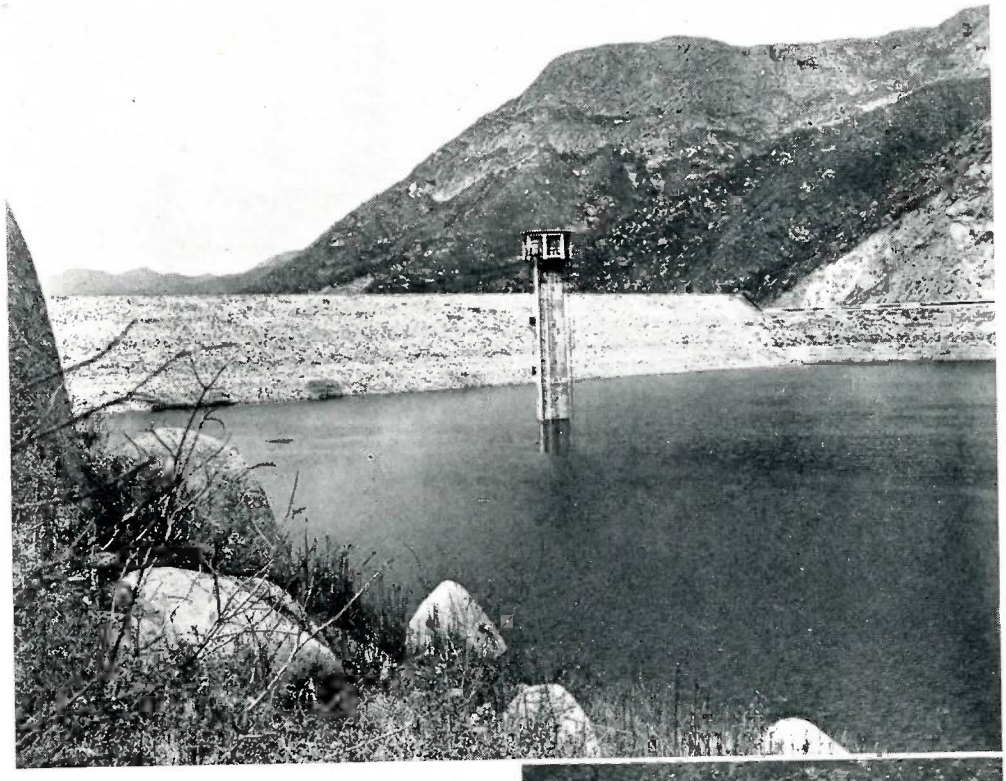
PRESENT SUPPLY

San Diego's normal water supply is now obtained from six large impounding reservoirs, twenty to sixty miles from the city. These reservoirs collect and store the surface waters which originate on the westerly slopes of the coastal mountains—a rocky, brush-covered range extending up to 6,000 feet in elevation. The total capacity of these reservoirs is some 131 *billion* gallons. But the last time they were all full was back in 1941, and now they are down to about 27 per cent of their capacity.

It became evident that something had to be done, and done quickly, to avoid complete exhaustion of the water reserves. Water rationing could be no more than a temporary and minor stopgap. Expansion of local storage sources would not be helpful, because it sometimes takes ten or twelve years to fill a large reservoir in this arid country. An outside source of supply was the only possible solution.

COLORADO RIVER SUPPLY

Thanks to the forethought of a group of citizens back in the 1920s, San Diego had obtained water rights on the Colorado River, across both a formidable mountain range and a desert from the Pacific slope. This sounded like the height of folly to many at the time, but how time has justified the early providers! Thanks also to the U. S. Navy, which had a vital interest in San Diego's water resources, a 71-mile aqueduct was built in record time to connect with the aqueduct of the Metropolitan Water District of Southern California.



El Capitan reservoir, the largest in San Diego's impounding system, has a storage capacity of 37.95 billion gallons, and a water surface of 1,574 acres. The structure —1,170 feet long with a top 217 feet above streambed — was completed in 1935, and within three years the reservoir was filled.

However, lack of rainfall and heavy demands for military, domestic, and industrial use have reduced its storage to about six per cent of capacity, as indicated in the photograph at the right. The reservoir has a 510-foot spillway, designed to control floods of 102,000 cubic feet per second.

Drainage area for the reservoir is 180 square miles, including that of Cuyamaca reservoir, owned by the La Mesa, Lemon Grove & Spring Valley Irrigation District, which has storage rights in El Capitan to 3.26 billion gallons.

●

The first Colorado River water finally came tumbling into San Diego's reservoir system in December, 1947. To those who realized the true picture, this arrival was a real hair-raiser which would surpass all the thriller movies in history. Just a few months' delay and the entire area would have suffered irreparable damage. Colorado River water is now flowing into the San Diego metropolitan area at about 64 m.g.d.—barely enough to meet the

consumption and the evaporation losses of the coming summer season.

DISTRIBUTION SYSTEM

It was not only in water resources that San Diego had growing pains. The transmission, purification, and distribution facilities were also left staggering by the impact of the city's tremendous growth. The number of services jumped from 47,504 in 1940 to 60,772 in 1947, and this in spite of the fact that the nineteen huge Federal Housing projects, totalling some 14,000 family units, have only master meters! New mains are going in at the rate of 92,000 feet per year, and new services at 3,200 per year.

In 1947, the Water Department had in service about 683 miles of distribution mains, aside from the 83 miles of large transmission lines and sixteen miles of open conduit coming into the city. There are thirteen pressure districts within the distribution system, as the residential areas run from the water's edge to 750 feet above sea level. These districts are served by fourteen electrically operated pump stations. And on the transmission lines into the city are three booster pump stations with a total capacity of 57 m.g.d.

Purification of San Diego's water is now by means of three filtration plants with a total capacity of 37 m.g.d., with necessary bypassing of some water to meet peak demands. There are seven chlorinator stations, and all water is delivered to the distribution system with a measurable chlorine residual.

FUTURE DEVELOPMENT

The largest single project for the immediate future is the construction of a 66 m.g.d. softening and filtration plant to treat local waters, Colorado River water, or any mixture of the two. In connection with this plant will be a 20 m.g. regulating reservoir. Total cost is expected to be about $3,400,000.

This aerial view of Parker Dam on the Colorado River shows part of the rugged terrain traversed by the Metropolitan Water District's aqueduct, which San Diego taps with its 71-mile aqueduct at the westerly portal of San Jacinto tunnel. The dam forms 50-mile-long Lake Havasu.

Several transmission line projects are now being built or are planned for the near future. Sizes will range up to 68-inch pipe. Total cost of the immediate projects will probably exceed $4,000,000. In the distribution system, reservoirs and pipe lines totalling over $3,000,000 are contemplated for the near future.

Getting water out of the sun-baked hills is quite a job! And getting it to town is another job. It all takes money and ingenuity and lots of work. But it just has to be, so long as people keep coming to San Diego to live.

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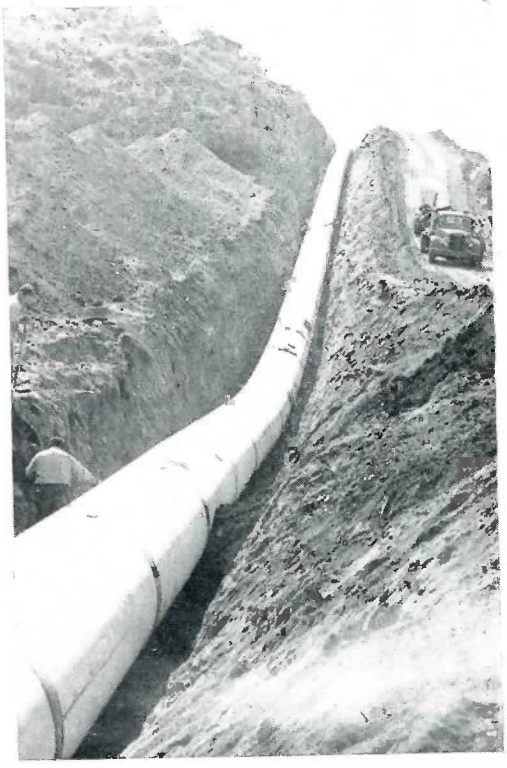
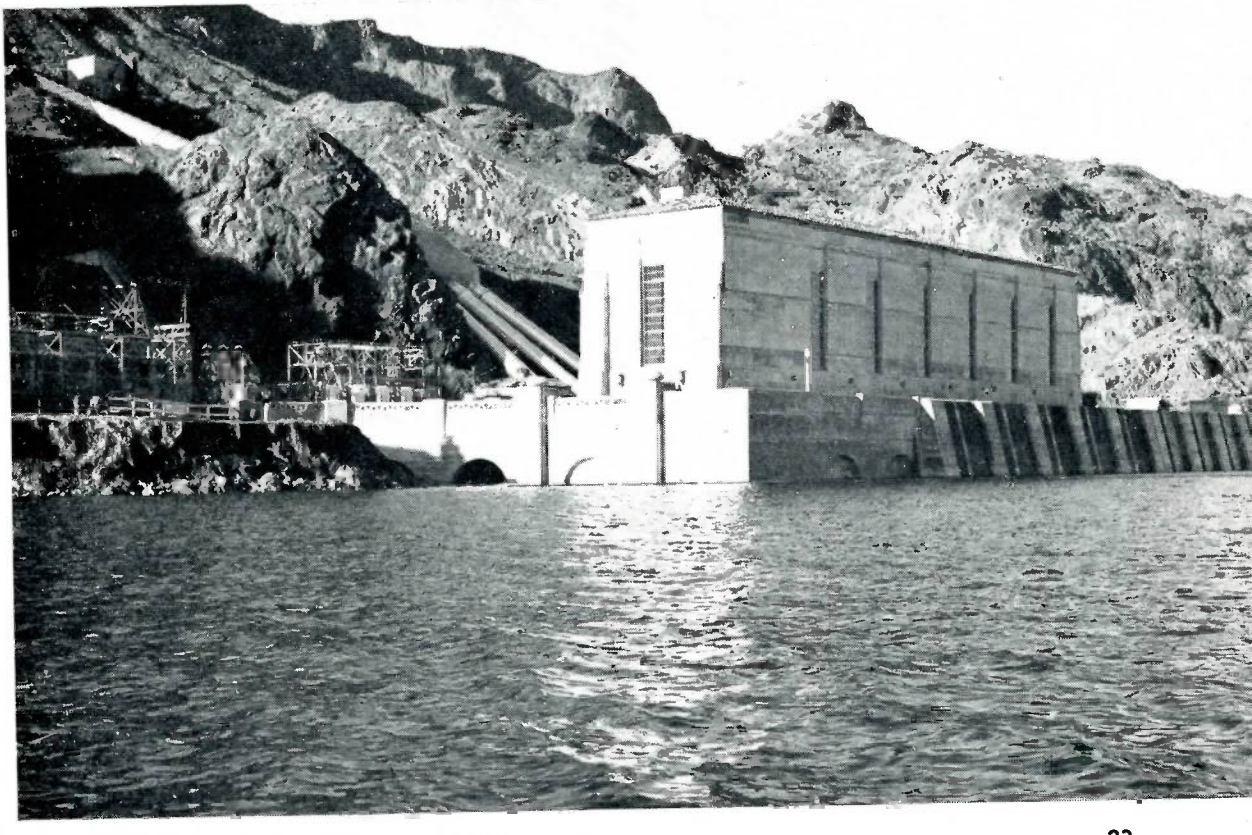


Right: A section of the San Diego aqueduct. From San Jacinto tunnel it extends in a southerly direction to San Vicente reservoir. The line includes seven tunnels, all in San Diego County, which range in length from 500 feet to 5,850 feet. Tunnels and some of the conduits in the relatively inaccessible terrain were built for an ultimate capacity of 100 m. g. d.

Below: The Metropolitan aqueduct intake pumping plant, which is located two miles upstream from Parker Dam on the California shoreline of Lake Havasu.



Linn H. Enslow To Succeed N. T. Veatch As A.W.W.A. Head

LINN H. ENSLOW, editor of *Water & Sewage Works* magazine, will take office May 7 as president of the American Water Works Association, succeeding N. T. Veatch, partner in the firm of Black & Veatch, consulting engineers, Kansas City, Missouri.

N. T. Veatch

Other officers are: Dr. A. P. Black, Gainesville, Florida, professor of chemistry at the University of Florida, vice-president; William W. Brush, New York City, editor of *Water Works Engineering,* treasurer; and Harry E. Jordan, New York City, secretary. Mr. Brush is serving his twenty-second year as treasurer of the A.W.W.A.

These officers will serve until the close of the 1949 Conference or until July 1, 1949, whichever date is earlier.

Also announced by the A.W.W.A. are awards made to Melvin P. Hatcher, Kansas City, and A. Clinton Decker, Birmingham. Mr. Hatcher received the John M. Goodell prize for his paper on "Waterworks Rules and Regulations," judged the most valuable paper of the year to be published in the *Journal* of the A. W. W. A., and Mr. Decker was voted the John M. Diven medal for his direction of a special A.W.W.A. committee of the water purification division.

Three honorary memberships in the organization also were awarded. In recognition of their contributions to water supply practices and their services to the association the memberships were voted to Louis R. Howson, Chicago; Abel Wolman, Baltimore; and Charles P. Hoover, Columbus.

Mr. Howson is a consulting engineer, Mr. Wolman is professor of sanitary engineering at Johns Hopkins University, and Mr. Hoover is a chemical engineer.

Melvin P. Hatcher

A. Clinton Decker

Abel Wolman

Louis R. Howson

Charles P. Hoover

A.W.W.A. OFFICERS

Linn H. Enslow, President

Linn H. Enslow has had wide experience in the water works field as a chemist and superintendent. Associated with the Maryland State Health Department from 1914 to 1918, he was assistant chemist in charge of the water and sewage laboratory before becoming chemist in charge of the filtration plant at Spartanburg, S. C. In 1919 he became a chemist at the Panama Canal and also served as superintendent of the filter plant at Gatun, C. Z. From 1920 to 1925 he was an assistant engineer with the Virginia State Department of Health, leaving to become research engineer for the Chlorine Institute of New York City. He became editor of *Water & Sewage Works* in 1931, and also serves the Chlorine Institute as a consulting engineer.

■ ■ ■

Dr. A. P. Black, Vice-President

Dr. A. P. Black, the association's vice-president, is professor of chemistry at the University of Florida and a consulting engineer to a considerable number of Florida municipalities, corporations and other organizations. He served in the Army's Chemical Warfare Service in World War I and was an assistant chemist with the Bureau of Standards before joining the faculty of the University of Florida as an assistant professor of chemical engineering in 1919. Dr. Black was a Fuller award winner in 1939, and is a past chairman and present secretary-treasurer of the Florida section, A. W. W. A.

■ ■ ■

William W. Brush, Treasurer

William W. Brush, editor of *Water Works Engineering,* has served consecutive terms as treasurer of the A.W.W.A. since 1930 and was also treasurer from 1922 to 1927. In addition, he served as the association's vice-president in 1928 and as president the following year. Mr. Brush was an engineer with the Brooklyn Water Department from 1894 to 1907 and the New York Board of Water Supply from 1907 to 1934, having become chief engineer in 1927. He became editor of *Water Works Engineering* in 1934. He was a Diven medalist in 1932 and was elected to honorary membership in the A.W.W.A. in 1937.

■ ■ ■

Harry E. Jordan, Secretary

Harry E. Jordan has been secretary of the A. W. W. A. and editor of the *Journal* of the American Water Works Association since 1936. Prior to that he served as the association's president in 1934-35. He was for thirty-three years chemical engineer with the Indianapolis Water Company. He served with the rank of major in the construction division of the Army's General Staff in World War I.

Off the . . Record . .

A visitor to an asylum asked an inmate his name.

"George Washington."

"But the last time I was here, you were Abraham Lincoln," the visitor said.

"That," said the man sadly, "was by my first wife."

* * *

Mrs. Jones: "Whenever I'm in the dumps I get myself a new hat."

Mrs. Smith: "I was wondering where you got them."

* * *

A drunk staggered from the tavern and started walking with one foot in the street and one on the sidewalk. After a block or so, he was accosted by a policeman with: "Hey, you're drunk."

"Thank goodness!" exclaimed the inebriated one, "I thought I was lame."

* * *

Joe: "Yes, sir, when that bear chased me I jumped for a limb twice as high as my head and I missed it."

Moe: "That was tough luck. How did you escape?"

Joe: "I missed the limb on the way up, but grabbed it coming down."

* * *

A chap was arrested for assault and battery and brought before the judge.

Judge (to prisoner): "What is your name, occupation, and what are you charged with?"

Prisoner: "My name is Sparks. I am an electrician, and I am charged with battery."

Judge (after recovering his equilibrium): "Officer, put this guy in a dry cell."

* * *

A robber was holding up passengers on a Pullman car. "Out with your dough or I'll kill all the men and molest the women," he shouted.

An elderly man said indignantly: "You shall not touch the ladies."

Just then an old maid in an upper berth yelled out, "You leave him alone. He's robbing this train."

* * *

He ordered two dozen roses to be sent to his loved one on her 24th birthday. "A rose for every precious year of your life," the card read.

The florist threw in an extra dozen because the young fellow was one of his best customers.

And the wedding hasn't taken place yet.

* * *

Two calves frisked up to a cow standing in a pasture.

One said, "Can my friend stay for dinner, Ma?"

* * *

Salesgirl: "Yes, Mrs. Gildpurse, our girdles come in five sizes . . . small, oh boy, large, wow, and holy smoke."

"They're slipping! Five years ago they made me look much younger!"

"Best salesman we ever had! First he reads his client's future and gets him so worried he signs immediately!"

A mother may hope her daughter will get a better husband than she did, but she knows her son will never get as good a wife as his father did.

* * *

"So your husband is one of the big guns of industry?"

"Yes, he's been fired seven times."

* * *

New Arrival: "What happened to the Pearly Gates? They're ruined."

Saint Peter: "A woman driver just came in."

* * *

"I can't quite diagnose your case," said the doctor. "I think it's drink."

"All right, doctor," the patient gravely replied. "I'll come back when you're sober."

* * *

Dignified Matron: "Where can I obtain a good covering for my settee?"

Bored Salesgirl: "Lingerie and corsets, fourth floor."

* * *

The first officer called a deck hand to him and said: "Go below and break up that crap game."

The sailor disappeared below, and remained for the better part of an hour. Upon his return the officer demanded: "Did you succeed in breaking up the game?"

"Yes, sir," replied the gob.

"Well, what in thunder took you so long?"

"Well, sir," the sailor replied, "I only had two bits to start with."

Mistress: "When you wait on the table tonight, please don't spill anything in front of my guests."

New Maid: "Don't worry, Ma'am. I don't talk very much."

* * *

"You can never talk to Mrs. Jones without hearing a long story about her ailments."

"Yes, you might almost call it an organ recital."

* * *

Customer (twice nicked by the barber's razor): "Hey, barber, gimme a glass of water."

Barber: "What's wrong, sir, hair in your mouth?"

Customer: "Naw, I wanna see if my neck leaks."

* * *

"Is your wife home?"

"No, she's out with a bunch of prize fighters."

"Prize fighters?"

"Yes, she went to a bridge party."

* * *

Mrs. Smythe: "I always feel better after a good, hard cry."

Mrs. Smith: "So do I. It sort of gets things out of your system."

Mrs. Smythe: "No, it doesn't get anything out of my system, but it does get things out of my husband."

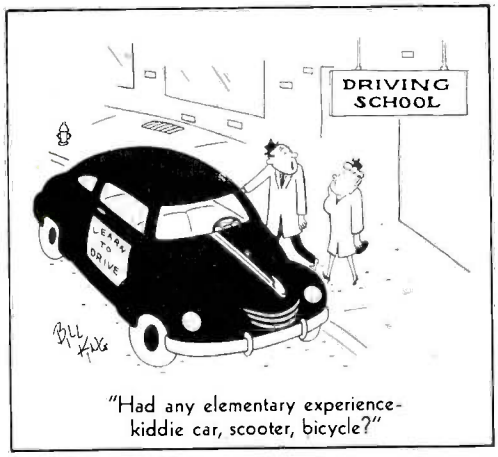
* * *

"Does your wife ever pay you any compliments?"

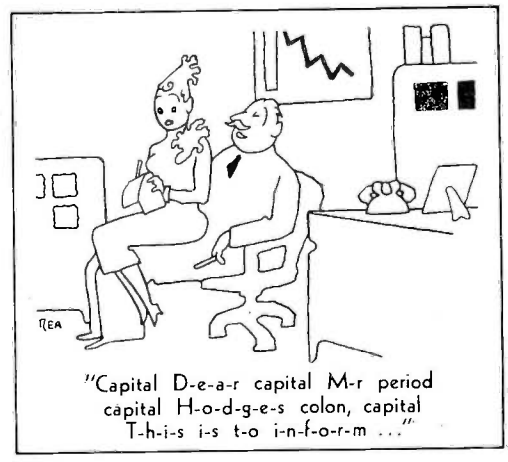
"Only in the winter."

"In the winter? What do you mean?"

"When the fire gets low, she says, 'Alexander, the grate.'"



"Had any elementary experience-kiddie car, scooter, bicycle?"



"Capital D-e-a-r capital M-r period capital H-o-d-g-e-s colon, capital T-h-i-s i-s t-o i-n-f-o-r-m ..."

GUNS are his HOBBY

Mueller Co. salesman says the Kentucky rifle was as important as the plow in development of U. S.

ABOUT SIX YEARS AGO, Floyd V. Johnson, Mueller Co. salesman, became interested in collecting souvenirs from some of the historic Civil War battlefields in his territory, which includes the states of Tennessee and Kentucky. From that start he began collecting guns, first from these two states and then from other points. Today his collection is valued at several thousand dollars and includes about 70 guns.

At first the collection grew something like Topsy, but as time went on it began to take definite shape. At present, with but a few minor gaps, the collection shows the complete development of the hand gun, from the matchlock, the first form of the hand gun, to modern side arms. The matchlock is a direct descendant of the hand cannon, which was the first type of fire arm to be carried by man.

"One cannot collect fire arms and omit the long arms, because, to my way of thinking, the 'Kentucky' rifle had as much to do with the early development of the United States as the plow," Johnson said.

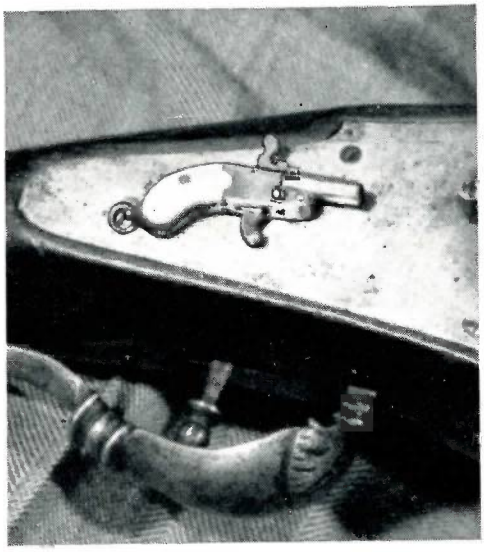
"Without this gun, as made by German gunsmiths mostly in and near Lancaster County, Pennsylvania, we would have been delayed a hundred years in winning our freedom, exploring and taking the country from the Indians, and, last but not least, in living from the kill off the land until it could be cleared, plowed and grain grown to feed the people, cattle, hogs and horses which came after the lone hunter on foot with his Kentucky rifle."

Included in Johnson's collection are the flint locks used from about 1675 to 1830, the percussion lock rifle, as well as the percusion type shotgun made by Hieronymus Mueller at Decatur, pin fire shotguns, the Henry rifle, which was the forerunner of the Winchester and the first Army repeating rifle which used

Floyd Johnson, Mueller Co. salesman, is shown at his home in Nashville, Tennessee, with a 46-inch barrel, .38 caliber Kentucky rifle of about 1750 vintage. This gun has no patch box in the stock as in the case of those made after the Revolutionary War. Johnson says the name "Kentucky" rifle is something of a misnomer, since they were made primarily in Pennsylvania. The adventurous Kentuckians of the period are responsible for naming the gun.

Part of Mr. Johnson's gun collection is shown in this photograph. This display includes, with but one or two gaps, the evolution of the hand gun from the matchlock, upper left, the earliest example (in use from 1375 to 1550 A. D.), to the modern versions.

cartridges. It was patented in 1860 and was first used by the Army about 1863. Another gun of this period is a Spencer repeating carbine, which the Army used about 1864, and among the service guns is a Prescott revolver of 1860, one of the first, if not the first, Navy cartridge hand gun.



The smallest gun in the collection is this 2 mm. watch charm pistol, measuring 1½ in.

The early matchlock hand gun, in use from 1375 to 1550, already has been mentioned, and, chronologically, it was followed by a wheel lock, invented in Germany about 1515. The one in Johnson's collection dates back to about 1580.

Following this are two miguelet lock guns, forerunners of the flint lock. These guns came into use about 1550, Johnson said.

Johnson has obtained several interesting flint locks for his collection. "Flint locks were in use longer than any other form of fire arm, and therefore are more plentiful. They are also, to me, more picturesque," Johnson said.

His flint locks include a blunderbuss, duelling pistols (one with two notches cut in the stock), a brass-barrelled, center hammer great coat pistol, and a dou-

ble-barrelled great coat pistol. He also has a pair of percussion great coat pistols with matched, gold inlaid stocks. The smaller guns of earlier days, of course, we called great coat pistols because they were carried in the owner's coat pocket.

There were—and are in Johnson's collection—also bootleg pistols, so called because they were carried in a rider's boot top. Later, this type gun came out with a smaller barrel and was generally carried in the whip stock of a buggy.

Among the percussion guns are a .44 caliber Colt 1860 model, which Union Army officers carried as a side arm in the Civil War, and a double-barrelled percussion pistol which was carried as a personal pocket arm at that time. Only recently a friend presented Johnson with the rusted remains of the latter type pistol, picked up on the Fort Donelson battlefield 85 years after the battle. This was a real find to Johnson, who already had an original in perfect condition.

Johnson said the first cartridge revolver made in America was the S&W .22 caliber revolver, and he has one of the first models. The gun was patented about 1855, and other manufacturers, noting the advantages of this type ammunition, received licenses to produce them.

Ladies were not overlooked by the early day gunsmiths, for Johnson has a pin fire Belgian muff revolver. The gun is small enough to be toted comfortably in a lady's muff without its shape becoming conspicuous. Pin fire cartridges gave way to rim and center fire cartridges over the period from 1860 to 1871.

The longest gun in Johnson's collection is the Kentucky rifle, which measures 61 inches overall, and the shortest and smallest gun is a 2 mm. pin fire watch charm pistol, which measures an inch and a half. The gun with the largest bore is a flint lock duelling pistol of about .62 caliber, and the smallest is the watch charm pistol, which is .062 caliber. The most valuable guns in the collection are the Kentucky long rifle and the early wheel lock pistol.

Assign Mueller Co. Engineer to Sales Territory

Lorin Grosboll to Cover North and South Carolina

LORIN GROSBOLL, A SENIOR ENGINEER for more than seven of the eleven years he has been with Mueller Co., has been assigned the sales territory of North and South Carolina, which was formerly covered by A. D. (Del) Parks.

Mr. Parks has been transferred to the territory formerly assigned to R. E. Kirchner, who retired recently after more than 41 years of service with Mueller Co. Mr. Parks' new territory includes Virginia and parts of Maryland and Pennsylvania.

Mr. Parks was assigned to the territory of North and South Carolina January 1, 1947, and has made many friends among Mueller Co. customers in that time. He will make his headquarters at Baltimore.

Mr. Grosboll will have his headquarters at Charlotte, North Carolina. He is married and has two children.

LORIN GROSBOLL

MOSTLY PERSONAL

(Continued from page 1)

The Texas, commissioned on March 12, 1914, saw fighting service in both world wars. Now 34 years old, she is considered too old for further active service.

The USS Texas first saw service with the Atlantic Fleet at Vera Cruz, Mexico, in 1914, and, later, after the United States entered World War I, moved to European waters with the British Grand Fleet. On her fifth day in that assignment she fired one shot at a German submarine, missing as the U-boat submerged, then ducked a torpedo fired a few seconds later.

In World War II, the USS Texas saw action in every theater of war, starting in the summer of 1940, when she participated in the so-called "neutrality patrol" in the North Atlantic.

During 1942, the USS Texas convoyed merchantmen to Europe, Africa and Panama. In the North African invasion she was assigned to ground troop support in the Mehdia-Port Lyautey area, where she fought for eight days.

Later she participated in the invasions of Normandy and Southern France. After VE-day, she moved to the Pacific in time to take part in the capture of Iwo Jima and Okinawa.

Many readers of the *Mueller Record* may recall a special issue which was published in November, 1942, commemorating the first automobile race in America, which took place on Thanksgiving Day, 1895. The late Oscar Mueller, driving a Mueller-Benz machine, came in second in that historic race, the winner being J. Frank Duryea.

At 78, Mr. Duryea is still active in automobile circles and maintains a keen interest in automobiles. While wintering in Pasadena, California, Mr. Duryea told a Los Angeles *Times* reporter recently that "cars should be built with consideration for special climatic conditions here," a statement that should catch on with the state's chambers of commerce, publicity men, and California's many other boosters, both the professional and the rank and file.

* * *

Acknowledgment is made herewith to Armstrong, Requa and Associates, San Diego advertising and public relations firm, for furnishing the photographs used to illustrate Roy E. Dodson's article on San Diego's water problem in this issue. The firm recently published, "San Diego's Quest for Water," an outstanding example of public relations in the water works field.

Official U. S. Navy Photo.

The battleship USS Texas, veteran of 34 years' service and action in both world wars, was turned over to the people of Texas on the anniversary of the victory at San Jacinto, the battle that established the independence of the Republic of Texas from Mexico. Considered too old for further active service, she will be maintained as a monument by her name state.

Give Your Customers What They Want

This is the Shower Head that everyone wants because it ends clogged and sputtery shower bathing once and for all!!! Every time the handle is turned to regulate the spray from a stinging needle shower to a soft rain patter, 28 **STAINLESS STEEL PINS** move back and forth through the holes in the face of the head, punching out all sediment.

Have your men just show it to the customer when they make their next service call and always keep them prominently displayed in your show room. Your jobber has them in stock, complete with Arm and Wall Flange, or with Head and Ball Joint only.

DEPENDABLE SINCE 1857 FULLY WARRANTED OUR 91st YEAR

MUELLER CO.

MAIN OFFICE AND FACTORY.....DECATUR, ILLINOIS
OTHER FACTORIES: *Los Angeles, Cal.; Chattanooga, Tenn.; Sarnia, Ont. Canada*

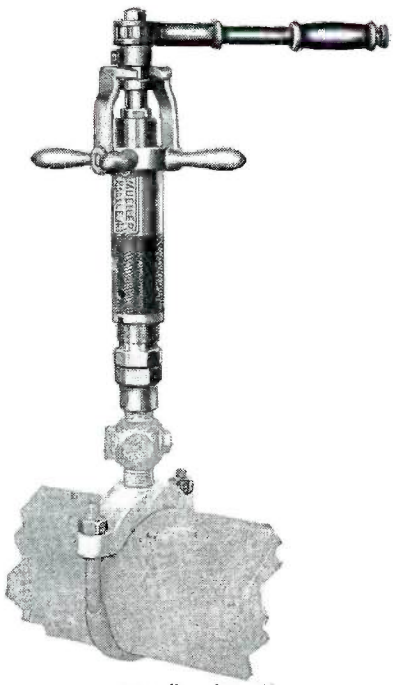
WHAT IS THE *Safe* WAY TO HANDLE HIGH OR INTERMEDIATE PRESSURES

The only SAFE way to handle low, intermediate or high pressures is to be sure that no gas blows or escapes when you cut into the main. By using the Mueller "D-4" or "E-4" Drilling and Inserting Machines, you can drill through a Stop and Service Clamp or a Welding Tee and make connections to the main without shutting off the pressure and without any loss of gas. Your work is carried on with ABSOLUTE SAFETY!!!

Mueller "SAFE-WAY" WELDING TEES are particularly efficient in that they can be welded on to the main and the service line completed. A valve and Drilling Machine are screwed on to the OUTSIDE thread of the Tee. The main is then drilled through the Tee and a plug inserted in the INSIDE thread. The Machine and valve are then removed and a cap put on the OUTSIDE thread to effect a double, leak-proof seal. There is no loss of gas at any stage of the entire operation.

Mueller
SAFE-WAY WELDING TEE
H-10410
Made in Sizes ¾" to 2" Inclusive

Mueller "D-4"
Drilling & Inserting Machine
Capacity 1" to 2" Inclusive



Mueller "E-4"
Drilling & Inserting Machine
Capacity 7/16" to 1" Inclusive

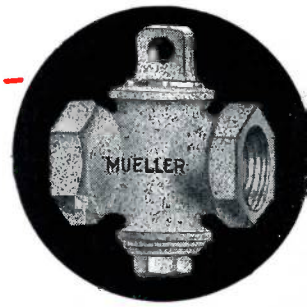
DEPENDABLE SINCE 1857 FULLY WARRANTED OUR 91st YEAR

MUELLER CO.

FACTORY: *Chattanooga, Tenn.* MAIN OFFICE AND FACTORY: *Decatur, Ill.*
OTHER FACTORIES: *Los Angeles, Cal.* ★ ★ ★ ★ *Sarnia, Ont. Canada*

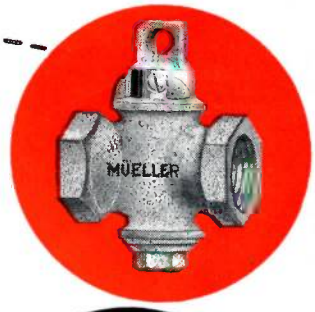
MUELLER OFFERS a wide selection OF GROUND KEY GAS STOPS

*H-11001 FLAT HEAD
H-11002 TEE HEAD
H-11003 SQUARE HEAD



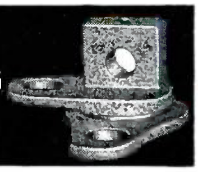
*ALSO FURNISHED IN HEAVIER GRADE (H-11007)

H-11004 FLAT HEAD WITH CHECK
H-11005 TEE HEAD WITH CHECK
H-11006 SQUARE HEAD WITH CHECK



**ALSO FURNISHED IN HEAVIER GRADE (H-11010)

H-11024 LOCK WING



H-11080 SOLID LEVER HANDLE WITH CHECK

Just select the styles you need—Mueller has them all and each one has the famous Mueller Ground Key Construction!! That means each key is ground and lapped into its own body to insure easy turning and a leak-proof seal. These low pressure stops are made in sizes up to and including 2 inches and are thoroughly tested with 80 lbs. air pressure while submerged in water—your assurance of satisfactory performance under actual service conditions whether used in Gas, Oil or Air Lines. Send us your requirements now.

MUELLER CO.

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OTHER FACTORIES: *Los Angeles, Cal.; Chattanooga, Tenn.; Sarnia, Ont. Canada*